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(54) DEVICE FOR FILTERING A LIQUID, PARTICULARLY FOR HYDRAULIC CIRCUITS OF HEATING SYSTEMS

(57) The device (100) comprises: a main body (110) having a first duct (111) for the inlet of the liquid to be filtered and a second duct (112) for the outlet of the filtered liquid; a filter cartridge (130) dividing a first volume (121) in fluid communication with the first duct (111) from a second volume (122) in fluid communication with the second duct (112); valve means (116, 145) for controlling the flow of the liquid from the first duct (111) to the first volume (121), said valve means (116, 145) comprising a valve seat (116) and a shutter member (145) movable with respect to the valve seat (116) between a closed position and an open position; and actuator means (140) for controlling the movement of the shutter member (145) between the closed position and the open position. The actuator means (140) comprise a rod (141), which is operatively associated with the shutter member (145) and is movable along an axis of translation (X), and a knob (144), which is configured to be driven into rotation by a user to move the rod (141). The rod (141) is locked with respect to rotation about the axis of translation (X) and has, at an end portion (141a) thereof facing away from the shutter member (145), a threaded cavity (141b). The actuator means (140) further comprise a shaft (143) which comprises a threaded portion (143a) engaging in the threaded cavity (141b) of the rod (141) and is drivingly connected for rotation with the knob (144), in such a manner that the rotational movement of the knob (144), and thus of the shaft (143), in one direction or the other, is converted into a translational movement of the rod (141), in one direction or the other, along the axis of translation (X). The actuator means (140) further comprise an actuator body (142) which rotationally supports the shaft (143) and guides the translational movement of the rod (141). Sealing means (147) are provided between the shaft (143) and the actuator body (142) and comprise, for example, a pair of gaskets axially spaced apart from each other.

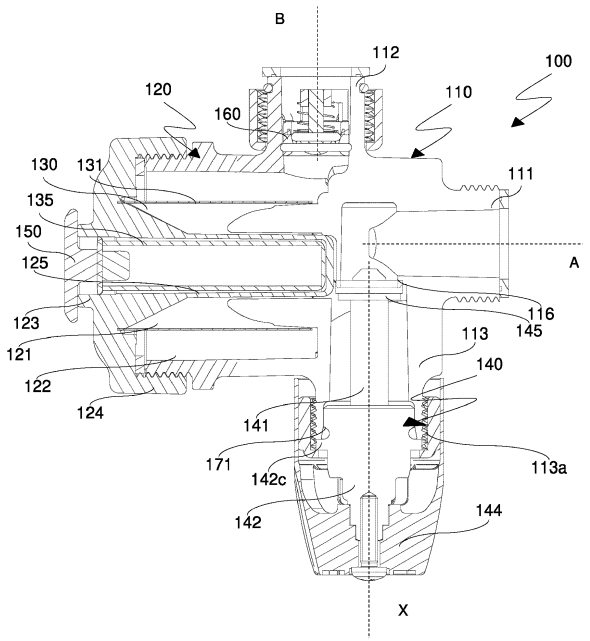

Fig.1

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Description

Technical field of the invention

[0001] The present invention relates generally to devices for filtering liquids, in particular for filtering water flowing in hydraulic circuits of heating systems. More specifically, though not necessarily, the present invention relates to a magnetic type filtering device, i.e. a device which also uses a magnetic filtering action in addition to a mechanical filtering action.

Background of the invention

[0002] In the field of water filtration devices, devices are known, also called dirt separators, which are typically used for removing impurities such as sludge and ferrous residues from the water flowing in hydraulic circuits of heating systems, for example in boilers for domestic use attached to radiators, radiant panels, or the like.

[0003] A device for filtering a liquid generally comprises a main body, or head, made of a metal or plastic material in which inlet and outlet ducts are provided for connection to a line pipe, and a cup-shaped casing in which a filtering cartridge having, for example, a cylindrical shape is housed. Coaxially to the filtering cartridge, which is typically made of a plastic or metal mesh, magnets may be housed to help retain ferrous impurities.

[0004] The cup-shaped casing is fixed to the main body in a removable manner, for example by means of a threaded ring nut associated with a flange provided with a sealing element. A flow of water entering the inlet duct in the main body is diverted to the cup-shaped casing where it passes through the filtering cartridge which retains the impurities with the help of the magnets, if present. The filtered water flowing out of the cup-shaped casing goes back into the main body and exits the device through the outlet duct.

[0005] A liquid filtration device comprising valve means for controlling the flow of water entering the main body of the device through an inlet duct is known from WO2018/207083. Such valve means comprise a shutter member, such as a plate, movable between a closed position and an open position, in which it prevents and allows the flow of incoming water, respectively. The shutter member is carried by a rod which is movable by translation along the direction of its longitudinal axis. The translational movement of the rod, along with the shutter member, between the closed position and the open position is controlled by the user by turning a knob. This known device is provided with a sealing system comprising a gasket arranged around the translating rod to prevent water from seeping outwards. However, this sealing system is not very satisfactory in terms of lifespan: the gasket around the rod may in fact deteriorate due to the translational movement of the rod, since the rod carries with it impurities from the inside the main body.

Summary of the invention

[0006] It is an object of the present invention to provide a device for filtering liquids which allows to overcome the above-mentioned drawbacks of the prior art.

[0007] This and other objects are fully achieved by virtue of a device as specified in the appended independent claim 1.

[0008] Preferred features of the present invention form the subject-matter of the dependent claims.

[0009] In summary, the invention is based on the idea of providing, for the control of the displacement of the shutter member between the closed position and the open position, actuator means comprising a rod which is locked with respect to rotation about an axis of translation, coinciding with its longitudinal axis, and has, at a first end thereof facing away from the shutter member, a threaded cavity in which a threaded portion of a shaft is engaged, said shaft being drivingly connected for rotation with a knob operable by the user, as well as on the idea of providing sealing means arranged on said shaft. Thanks to the fact that the sealing means are provided on the rotating shaft, instead of on the translating rod, such means are less subject to wear and therefore maintain their effectiveness for a very long period of time.

Brief description of the drawings

[0010] Further features and advantages of the present invention will be apparent from the following detailed description of some embodiments, given purely by way of non-limiting example with reference to the Figures of the accompanying drawings, wherein:

- Figure 1 is a sectional view showing a device for filtering a liquid according to a first embodiment of the present invention, with the shutter member in a closed position;
- Figure 2 is a sectional view of the device of Figure 1, with the shutter member in an open position;
- Figure 3 is an exploded view of the device of Figure 1;
- Figure 4 is a partial sectional view of the actuating means of the device of Figure 1; and
- Figure 5 is a sectional view of a device for filtering a liquid according to a second embodiment of the present invention.

Detailed description

[0011] With reference first to Figures 1 to 3, a device for filtering a liquid, particularly for filtering water in hydraulic circuits of heating systems, is generally indicated 100 and comprises:

- a main body 110, having a first duct 111 for the inlet of the liquid to be filtered and a second duct 112 for the outlet of the filtered liquid, the first duct 111 and the second duct 112 extending along a first longitu-

dinal axis A and along a second longitudinal axis B, respectively;
- a filter cartridge 130;
- valve means for controlling the flow of the liquid entering the main body 110 through the first duct 111; and
- actuator means 140 for controlling said valve means.

[0012] According to an embodiment, the second longitudinal axis B is arranged at 90° to the first longitudinal axis A. However, this arrangement is not essential for the purposes of the present invention.

[0013] The main body 110 further comprises a hollow cylindrical portion 120 which is closed by a lid 124 and is configured to house the filter cartridge 130. Said filter cartridge 130 divides a containment volume defined by the hollow cylindrical portion 120 into a first volume 121, in fluid communication with the first duct 111, and a second volume 122, in fluid communication with the second duct 112. The first volume 121 and the second volume 122 are in turn in fluid communication with each other through the filter cartridge 130.

[0014] The valve means are configured to control the flow of the liquid from the first duct 111 to the first volume 121. Such means comprise a valve seat 116, disposed in the fluid path between the first duct 111 and the first volume 121, and a shutter member 145 movable with respect to the valve seat 116 between a closed position and an open position, in which it interrupts and allows, respectively, the flow of the liquid from the first duct 111 to the first volume 121 through the valve seat 116. The shutter member 145 is formed for example by a plate, preferably provided with a sealing gasket 145a.

[0015] The actuator means 140 are configured to control the movement of the shutter member 145 between the above-mentioned closed and open positions. With reference also to Figure 4, such means comprise a rod 141, which is operatively associated with the shutter member 145 and shiftable along an axis X coinciding with its longitudinal axis, an actuator body 142, which is mounted on the main body 110 and guides the rod 141 in its translational movement along the axis X, and a knob 144, which is configured to be driven into rotation by a user to move the rod 141.

[0016] According to the embodiment of Figures 1 to 4, the shutter member 145 is constrained to the rod 141 (more specifically, at an upper end portion thereof, indicated 141c) so as to be drivingly connected for translation therewith. Advantageously, the rod 141 has, at an end portion 141a thereof facing away from the shutter member 145 (in the present case, the lower end portion), a threaded cavity 141b, i.e. a cavity inside the end portion 141a a portion of whose inner surface is threaded, the axis of the threading being substantially coincident with the axis X of the rod 141. The end portion 141a of the rod 141 is slidably received into a polygonal seat 142a of the actuator body 142 and has a cross-section with a polygonal shape corresponding to that of the seat 142a, in such a manner that the rod 141 is prevented from rotating relative to the actuator body 142 about the axis X.

[0017] The actuator means 140 further comprise a shaft 143 having at an end thereof facing away from the knob 144 (in the present case the upper end) a threaded portion 143a which engages in the threaded cavity 141b of the rod 141. The shaft 143 is drivingly connected for rotation with the knob 144, in such a manner that the rotational movement of the knob 144, and therefore of the shaft 141, in one direction or the other, about the axis X is converted into a translational movement of the rod 141, in one direction or the other, along the axis X. The shaft 143 is supported for rotation by the actuator body 142, namely in a cylindrical cavity 142b thereof. The actuator body 142 is provided internally with first sealing means for ensuring sealing between the shaft 143 and the surface of the cylindrical cavity 142b. Preferably, such first sealing means comprise two sealing gaskets 147, for example two O-rings, arranged axially spaced apart from each other on the shaft 143.

[0018] In an embodiment, the main body 110 comprises a second cylindrical portion 113 which extends along the axis of translation X and has a threaded end 113a defining a mouth. The actuator body 142 is partially inserted through said mouth and constrained to the main body 110. More particularly, a clamping ring nut (or cap) 170 is configured to screw onto the threaded end 113a of the second cylindrical portion 113 so as to clamp a flange portion 142c of the actuator body 142, having a diameter greater than the inner diameter of the cylindrical portion 113, against said threaded end 113a. The actuator body 142 is thus blocked with respect to the main body 110. Second sealing means, comprising for example an O-ring seal 171 arranged around the actuator body 142, preferably resting on the upper face of the flange portion 142c, ensure sealing between the second cylindrical portion 113 and the actuator body 142. The ring nut 170 is advantageously made of brass, which makes it possible to avoid the formation of cracks or fissures that can instead occur in the filtering devices of the prior art, in which the male threaded portion of the actuator body is screwed into a female threaded portion of the main body of the device which, being typically made of a plastic material, may crack as a result of the screwing of the actuator body into it, thus creating problems with the sealing of the device.

[0019] As mentioned, in a first embodiment of the invention (Figures 1-4) the shutter member 145 is integral with the rod 141 in the translation movement along the axis X. In this way, the action of rotation of the knob 144 by a user is converted, due to the engagement between the threaded portion 143a of the shaft 143 in the threaded cavity 141b of the rod 141 and to the rotational locking of the rod 141, into a translation movement of the rod 141, and hence of the shutter member 145, along the axis X, the amount of which is directly proportional to the angle of rotation of the knob 144.

[0020] Referring now to Figure 5, in which parts and

elements identical or corresponding to those of the preceding Figures are indicated with the same reference numerals, in a second embodiment of the present invention the shutter member 145 is separate from the rod 141 and is normally held by elastic means (not shown) against the valve seat 116 to prevent the flow of the liquid from the first duct 111 to the first volume 121. The rod 141 is in this case configured to push the shutter member 145 away from the valve seat 116 against the action of the elastic means. Preferably, the shutter member 145 and the rod 141 are arranged on opposite sides of the valve seat 116. More particularly, the elastic means are preferably housed in a special chamber 114 of the main body 110. With reference to Figures 1-3 and 5, in both the first embodiment and the second embodiment of the device 100 the filter cartridge 130 comprises a mesh 131 which is arranged along a coaxial cylindrical surface inside the hollow cylindrical portion 120 and is configured to filter the water flowing from the first volume 121 to the second volume 122. Preferably, the filter cartridge 130 further comprises one or more magnetic inserts 135 configured to attract fine ferrous-type particulate present in the water flowing through the first volume 121. More particularly, the lid 124 includes a cylindrical cup-shaped container 125, coaxial with the hollow cylindrical portion 120 of the main body 110, having an opening in the region of the lid 124. The cylindrical cup-shaped container 125 defines a containment volume for the one or more magnetic inserts 135. A cap 150 closes the opening of the cylindrical cup-shaped container 125 at a hollow cylindrical extension 123 protruding from the lid 124 to the outside of the device 100.

[0021] According to a further advantageous aspect of the present invention, which may be provided both in the first embodiment and in the second embodiment illustrated above, the device 100 further comprises a check valve 160 arranged in the second duct 112 to prevent the flow of liquid entering through said duct and thereby allow flow through said duct only in the direction exiting the main body 110.

[0022] The present invention has been described with reference to preferred embodiments thereof. It will be understood that there may be further embodiments sharing the same inventive concept, as defined by the scope of protection of the appended claims.

Claims

1. Device (100) for filtering a liquid, particularly for filtering water in hydraulic circuits of heating systems, comprising:

   - a main body (110) having a first duct (111) for the inlet of the liquid to be filtered and a second duct (112) for the outlet of the filtered liquid, said main body (110) further comprising a hollow cylindrical portion (120);
   - a filter cartridge (130) housed in said hollow cylindrical portion (120) so as to divide a containment volume defined by said hollow cylindrical portion (120) into a first volume (121), in fluid communication with said first duct (111), and a second volume (122), in fluid communication with said second duct (112);
   - valve means (116, 145) for controlling the flow of the liquid from said first duct (111) to said first volume (121), said valve means (116, 145) comprising a valve seat (116) interposed between said first duct (111) and said first volume (121) and a shutter member (145) movable with respect to said valve seat (116) between a closed position and an open position, in which it interrupts and allows, respectively, the flow of the liquid from said first duct (111) to said first volume (121) through said valve seat (116);
   - actuator means (140) for controlling the movement of the shutter member (145) between said closed position and said open position, wherein said actuator means (140) comprise a rod (141), which is operatively associated with the shutter member (145) and is shiftable along an axis of translation (X) coinciding with its longitudinal axis, an actuator body (142), which is mounted on the main body (110) and is configured to guide said rod (141) in its translational movement of along said axis of translation (X), and a knob (144) configured to be driven into rotation by a user to move said rod (141), and a shaft (143) drivingly connected for rotation with said knob (144); and
   - first sealing means (147) arranged inside the actuator body (142);

   characterized

   in that said rod (141) is locked with respect to rotation around said axis of translation (X) and has, at a first end portion (141a) thereof facing away from the shutter member (145), a threaded cavity (141b);
   in that the shaft (143) comprises a threaded portion (143a) engaging in said threaded cavity (141b) of the rod (141), in such a way that the rotational movement of the knob (144), and therefore of the shaft (143), in one direction or the other, is converted into a translational movement of the rod (141), in one direction or the other, along said axis of translation (X); and
   in that said first sealing means (147) comprise at least one gasket mounted on said shaft (143).

2. Device according to claim 1, wherein said first sealing means (147) comprise two gaskets, in particular two O-rings, arranged on said shaft (143) so as to be axially spaced apart from each other.

3. Device according to claim 1 or claim 2, wherein said first end portion (141a) of the rod (141) has a polygonal cross section slidably housed inside a corresponding polygonal seat (142a) in the actuator body (142) so as to prevent the rod (141) from rotating relative to the actuator body (142).

4. Device according to any one of the preceding claims, wherein said shutter member (145) is drivingly connected with said rod (141).

5. Device according to claim 4, wherein said shutter member (145) is constrained to a second end portion (141c) of said rod (141) opposite to said first end portion (141a).

6. Device according to any one of claims 1 to 3, wherein said shutter member (145) is separate from the rod (141) and is normally held by elastic means against said valve seat (116) to prevent the flow of the liquid from said first duct (111) to said first volume (121), and wherein said rod (141) is configured to push said shutter member (145) away from said valve seat (116) against the action of said elastic means.

7. Device according to claim 6, wherein said shutter member (145) and said rod (141) are arranged on opposite sides of said valve seat (116).

8. Device according to any one of the preceding claims, wherein said main body (110) comprises a second cylindrical portion (113), extending along the axis of translation (X) and having a threaded end (113a), wherein the actuator body (142) comprises a flange portion (142c) having a greater diameter than the internal diameter of said second cylindrical portion (113), and wherein the device further comprises a clamping ring nut (170) configured to be screwed to said threaded end (113a) so as to clamp said flange portion (142c) of the actuator body (142) against said threaded end (113a) in such a way that the actuator body (142) is blocked with respect to the main body (110), and second sealing means (171) interposed between the actuator body (142) and said threaded end (113a).

9. Device according to any one of the preceding claims, further comprising a check valve (160) arranged in said second duct (112) to allow the flow of the liquid through said second duct (112) only in the direction exiting the main body (110).

10. Device according to any one of the preceding claims, wherein said shutter member (145) is a plate provided with a gasket (145a).

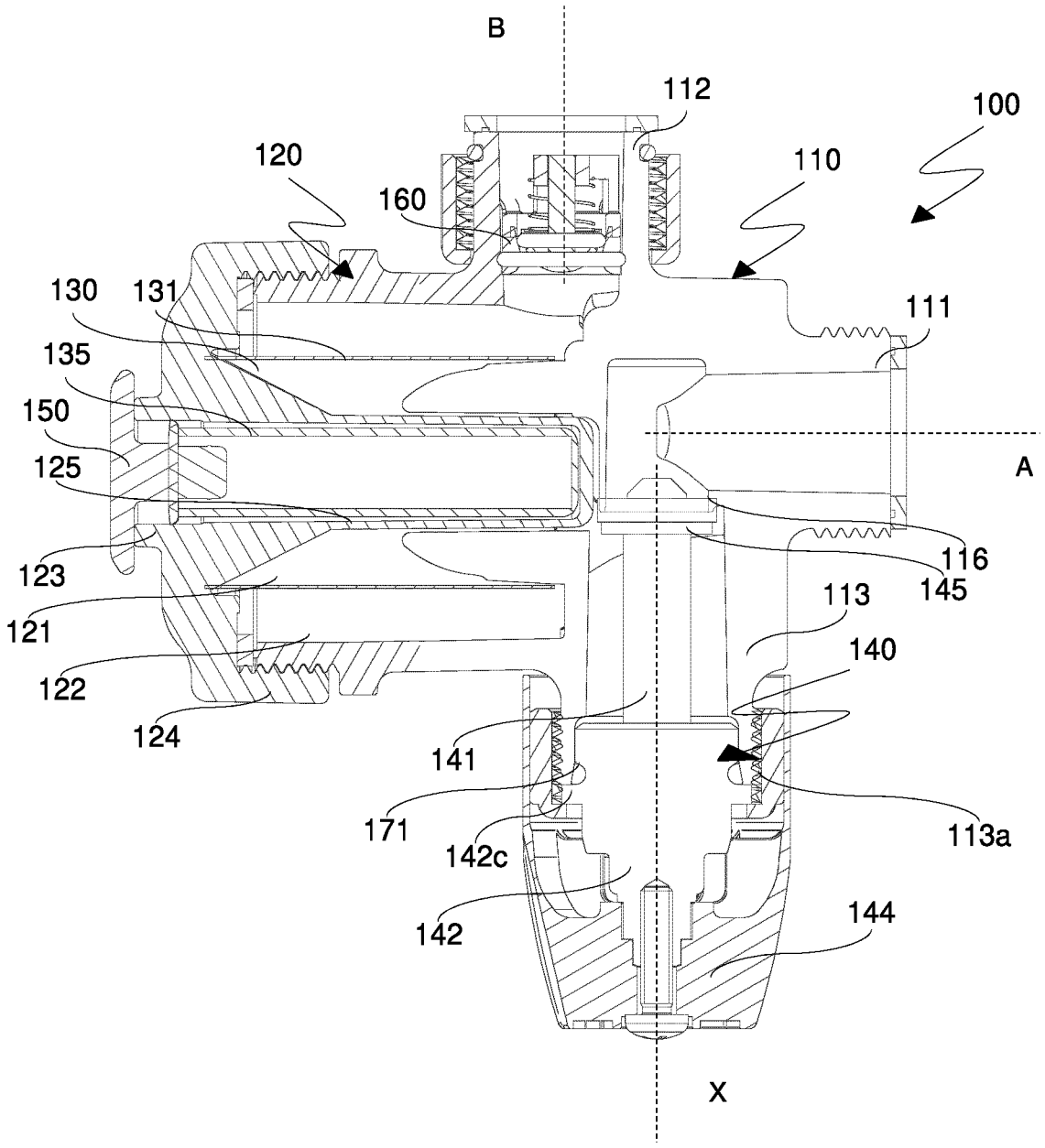
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Fig.1

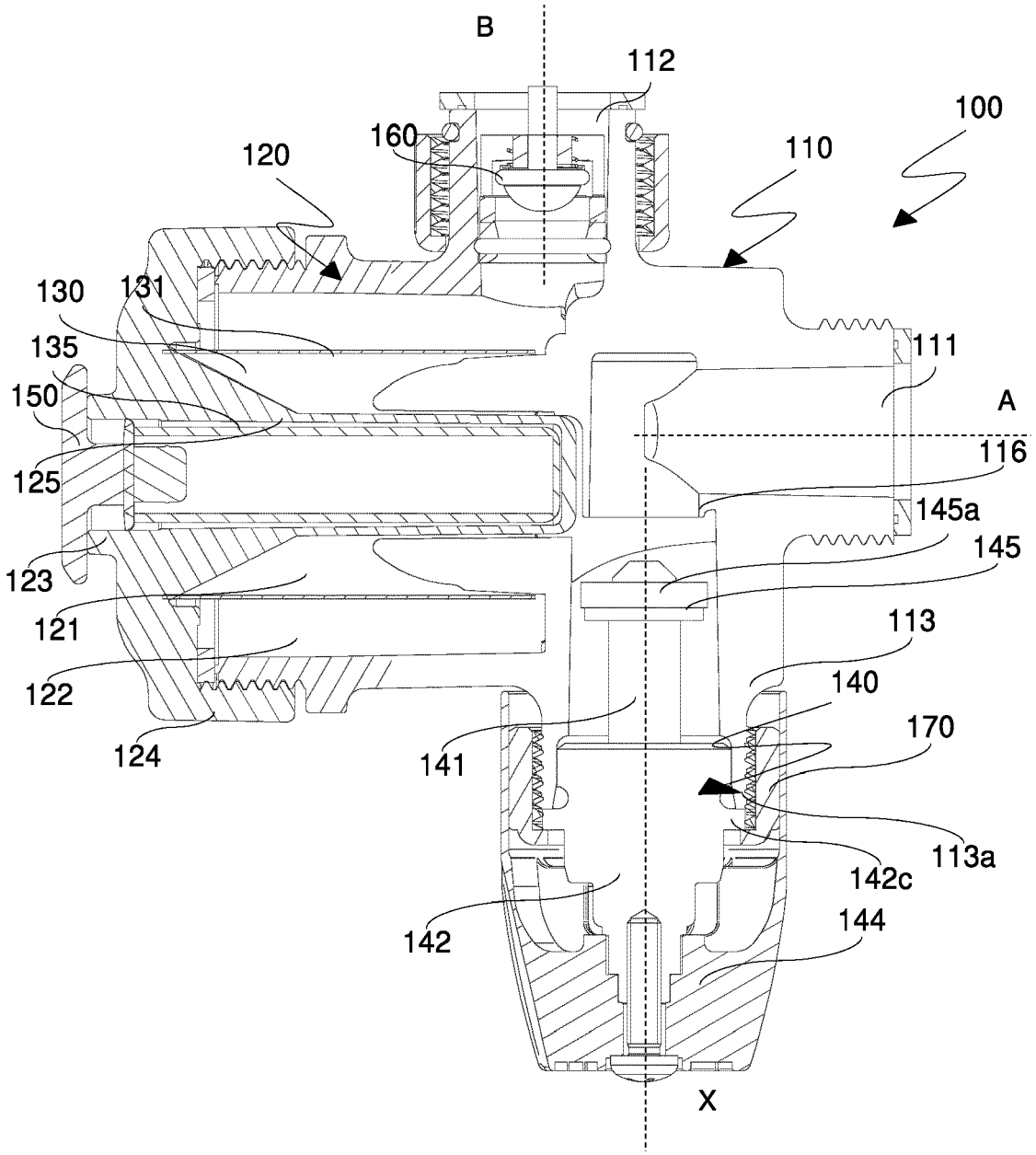
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Fig.2

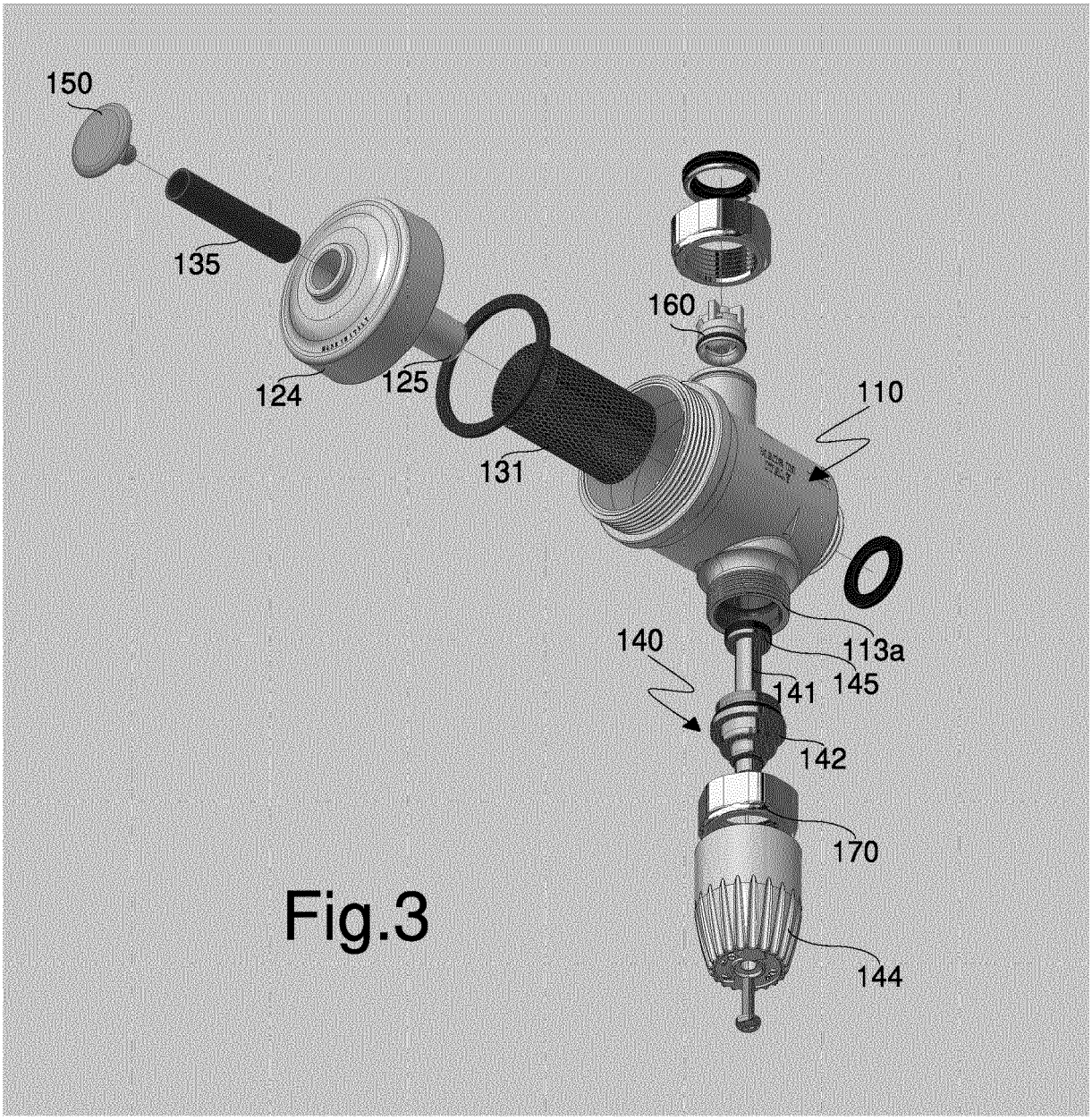

Fig.3

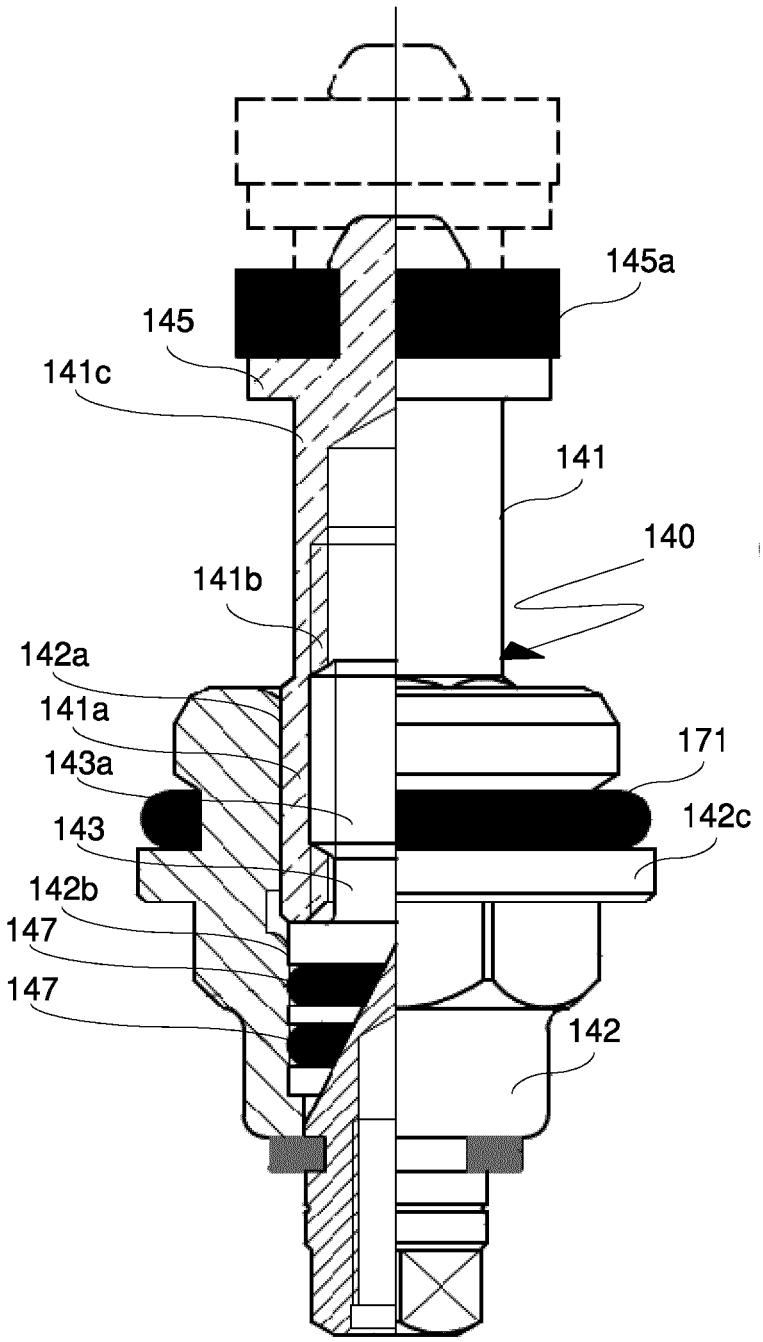
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Fig.4

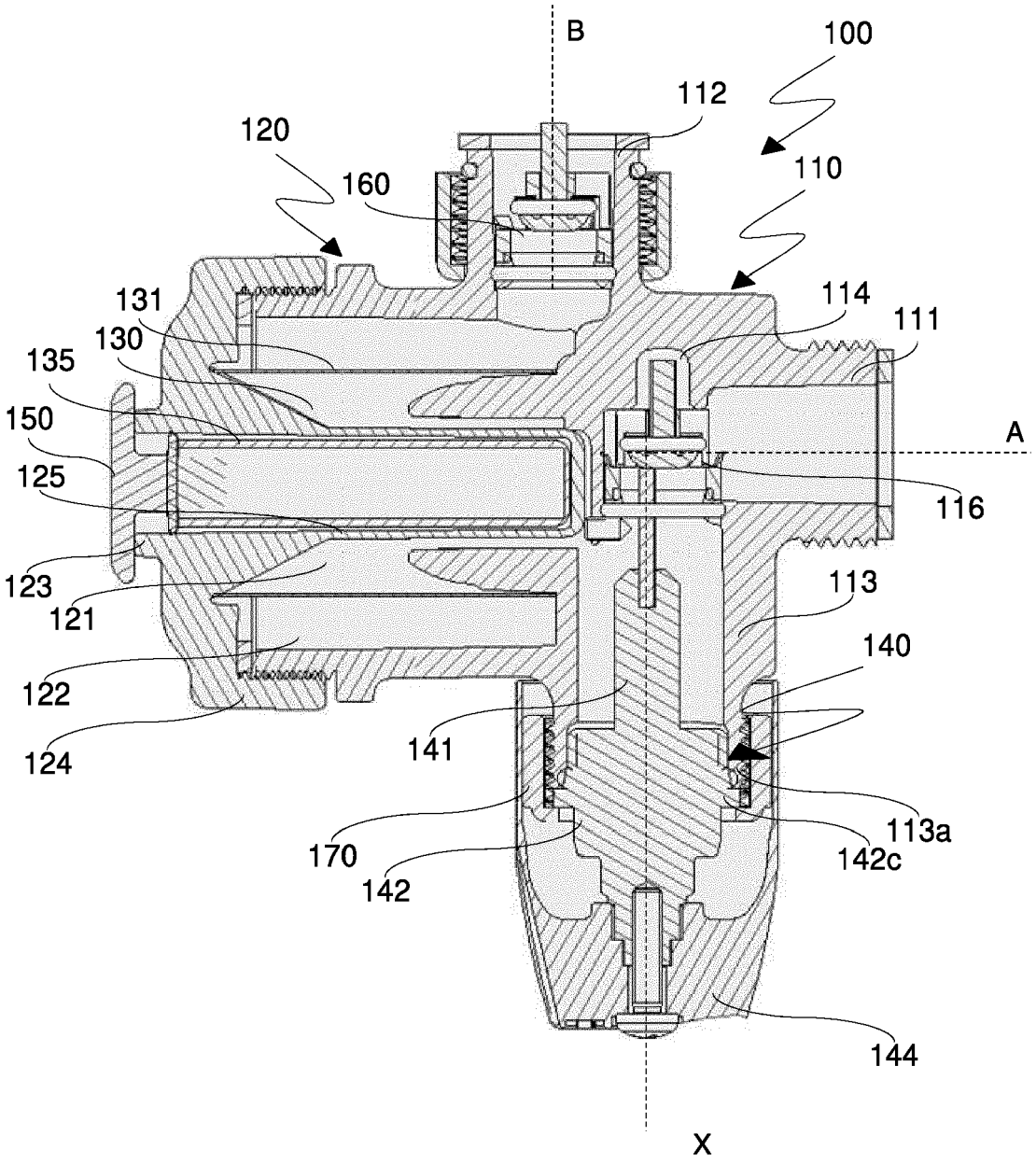
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Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 2212

DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2022	Galiana López, Paula

CATEGORY OF CITED DOCUMENTS

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